REMARKS

Claims 11, 12 and 15 have been amended to more clearly describe Applicants' invention. New claims 49-50 have been added. Support for the new claims and the amend claims can be found throughout the specification, for example, at page 3, lines 23-24, and page 10, lines 13-15. No new matter has been added. Claims 1-50 are pending.

Applicants believe that the amendments of claims 11 and 12 have addressed the Examiner's objection at page 2 of the Office Action. Withdrawal of the rejection is respectfully requested.

Rejection under 35 U.S.C. § 102(e)

Claims 15-19 and 21-31 have been rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,274,323 to Bruchez *et al.* ("Bruchez"). See pages 2-3 of the Office Action. Claims 15 and 24 are independent. Claims 16-19 and 21-23 depend from claim 15; claims 25-31 depend from claim 24.

According to the Examiner, "Bruchez discloses a semiconductor nanocrystal in an organic or inorganic polymer (binder)." See page 2 of the Office Action. The Examiner then details other information allegedly disclosed in Bruchez.

Independent claim 15 features a temperature sensor. The temperature sensor includes a matrix containing a semiconductor nanocrystal. The matrix is formed from a semiconductor nanocrystal and a binder. The sensor also includes a light source arranged to illuminate the semiconductor nanocrystal, and a detector arranged to detect light emitted from the semiconductor nanocrystal. Bruchez does not disclose a temperature sensor, or a temperature sensor that includes a matrix formed from a semiconductor nanocrystal and a binder. In addition, a matrix formed from a binder is not disclosed by Bruchez. Moreover, Bruchez does not disclose a temperature sensor including the matrix, a light source and a detector. Accordingly, independent claim 15 and claims 16-19 and 21-23 that depend from claim 15 are not anticipated by Bruchez.

Independent claim 24 features a temperature-sensing coating including a matrix on a surface of a substrate. The matrix includes a semiconductor nanocrystal in a binder. Bruchez does not disclose temperature-sensing coating on a surface of a substrate. Moreover, Bruchez does not disclose a temperature-sensing coating including a matrix that includes a semiconductor

nanocrystal in a binder. In addition, a matrix formed from a binder is not disclosed by Bruchez. Accordingly, independent claim 24 and claims 35-31 that depend from claim 24 are not anticipated by Bruchez.

Applicants respectfully request reconsideration and withdrawal of the anticipation rejection over Bruchez.

Rejections under 35 U.S.C. § 103(a)

Bruchez

The Examiner has rejected claim 20 under 35 U.S.C. § 103(a) as being unpatentable over Bruchez. See page 3 of the Office Action. Claim 20 depends from independent claim 15.

According to the Examiner,

> Bruchez discloses a semiconductor nanocrystal and binder having all of the limitations of claim 20, as stated in paragraph 3, except for the overlayer including a metal alkoxide.
>
> The use of the particular type of hydrolysable moiety claimed by application, i.e., a metal alkoxide, absent any criticality, is considered to be nothing more than a choice of engineering skill, choice, or design because the use of the particular moiety claimed by applicant is considered to be nothing more than the use of numerous and well known alternate types of hydrolyzable moieties that a person of ordinary skill in the art at the time the invention was made would have been able to provide using routine experimentation in order to provide a hydrolyzable nanocrystal as already suggested by Bruchez.

Applicants respectfully disagree. Bruchez does not describe or suggest a hydrolyzable nanocrystal as asserted by the Examiner. While Bruchez does describe modifying surface functionalities of a semiconductor nanocrystal at column 21, line 44 through column 23, line 16, Bruchez does not teach hydrolysable nanocrystals.

Moreover, claim 15 features a temperature sensor that includes a matrix containing a semiconductor nanocrystal. The matrix is formed from a semiconductor nanocrystal and a binder. The sensor also includes a light source arranged to illuminate the semiconductor nanocrystal, and a detector arranged to detect light emitted from the semiconductor nanocrystal. Bruchez does not teach or suggest a temperature sensor, or a temperature sensor that includes a matrix formed from a semiconductor nanocrystal and a binder. In addition, a matrix formed

from a binder is not taught by Bruchez. Moreover, Bruchez does not teach or suggest a temperature sensor including the matrix, a light source and a detector. Indeed, Bruchez does not recognize that a nanocrystal can be used in a temperature sensor.

Accordingly, claim 20 is patentable over Bruchez. Applicants respectfully request reconsideration and withdrawal of the obviousness rejection over Bruchez.

Britton in view of Bruchez

The Examiner has rejected claims 1-14 and 48 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,986,272 to Britton, Jr. ("Britton") in view of Bruchez. See page 4 of the Office Action. Claims 1 and 48 are independent. Claims 2-14 depend from claim 1.

The Examiner recognizes that "Britton does not disclose the temperature sensor being a semiconductor nanocrystal in a binder." See page 4 of the Office Action. The Examiner relies of Bruchez for teaching a semiconductor nanocrystal, and states that

> [r]eferring to claims 1 and 48, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the semiconductor nanocrystal in a binder disclosed by Bruchez as the luminescent coating in the temperature measuring method disclosed by Britton, since these coatings are alternative types of luminescent coatings that can determine the temperature of a substrate (pages 4-5 of the Office Action).

Applicants respectfully disagree. Neither Britton nor Bruchez, nor combinations of Britton and Bruchez teach or suggest a method of sensing temperature including a temperature sensor including a semiconductor nanocrystal.

Independent claims 1 and 48 feature a method of sensing temperature. The method includes providing a temperature sensor including a matrix on a surface of a substrate, the matrix including a semiconductor nanocrystal in a binder, irradiating a portion of the sensor with an excitation wavelength of light, detecting emission of light from the sensor, and determining the temperature from the emission of light from the sensor.

The Examiner relies on Britton for teaching all aspects of independent claims 1 and 48 except for the matrix including a semiconductor nanocrystal in a binder. However, Britton

describes a "method and apparatus for determining the decay-time constant of a fluorescing phosphor." See column 2, lines 12-13 of Britton. The fluorescing phosphor described in Britton is "yttrium vanadate doped with europium." See column 3, line 62 of Britton. Britton does not teach or suggest any other materials that can be used as a temperature sensor. Instead, Britton teaches aspects of the apparatus used to "provide real-time temperature measurements." See column 2, lines 16-17 of Britton. Thus, nothing in Britton teaches or suggests a temperature sensor including a matrix on a surface of a substrate, the matrix including a semiconductor nanocrystal in a binder. Indeed, there is no motivation provided in Britton to choose any material other than yttrium vanadate doped with europium to provide real-time temperature measurements. Certainly, there is no motivation to form a temperature sensor including a matrix including a semiconductor nanocrystal in a binder in Britton.

Bruchez does not relate to sensing temperature. Instead, Bruchez teaches a method of detecting an analyte in a sample. See Title of Bruchez. Bruchez does not teach or suggest forming a temperature sensor including a matrix including a semiconductor nanocrystal in a binder. Bruchez does not teach or suggest including a matrix on a surface of a substrate. Indeed, Indeed, Bruchez does not even recognize that a semiconductor nanocrystal exhibits a temperature dependent emission spectrum. See, for example, page 11, lines 16-18 of the specification. Without such a recognition or suggestion, there is no motivation in Bruchez to use a semiconductor nanocrystal in a temperature sensor.

There is no motivation to combine the teachings of Bruchez and Britton. Neither reference recognizes that semiconductor nanocrystals can be used in a method of sensing temperature.

Obviousness cannot be established simply by stitching together pieces of prior art using the patent as a template. Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1143 (Fed. Cir. 1985); see also Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 873 (Fed. Cir. 1985) (denouncing courts' tendency to depart from proper standard of nonobviousness "to the tempting but forbidden zone of hindsight."); In re Fine, 837 F.2d 1071, 1075 (Fed. Cir. 1988) ("One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention."); In re Dembiczak, 175 F.3d 994, 999 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a

hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."). The cited references must provide some suggestion, motivation, or teaching for combining known components. See Heidelberger Druckmaschinen AG v. Hantscho Commercial Prods., Inc., 21 F.3d 1068, 1072, 30 USPQ2d 1377, 1379 (Fed.Cir.1994) ("When the patented invention is made by combining known components to achieve a new system, the prior art must provide a suggestion or motivation to make such a combination."); C.R. Bard, Inc. v. M3 Systems, Inc., 157 F.3d 1340 (Fed. Cir. 2000). The requisite motivation to combine the references has not been provided. Thus, the Examiner has not presented a *prima facie* case of obviousness.

Thus, the methods of claim 1 and 48 and claims that depend therefrom are patentable over the combination of Britton with Bruchez. Applicants respectfully request reconsideration and withdrawal of this rejection.

Gallery in view of Bruchez

The Examiner has rejected claims 32-47 under 35 U.S.C. § 103(a) as being unpatentable over "Luminescent Thermometry for Aerodynamic Measurements" by Gallery *et al.* ("Gallery") in view of Gallery. See pages 5-6 of the Office Action. Claim 32, 43 and 45 are independent. Claims 33-44 depend from claim 32; claims 46-47 depend from claim 45.

The Examiner recognizes that "Gallery does not disclose the temperature sensor being a semiconductor nanocrystal in a binder." See page 6 of the Office Action. The Examiner relies of Bruchez for teaching a semiconductor nanocrystal, and states that

> [r]eferring to claims 1 and 43,[1] it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the semiconductor nanocrystal in a binder disclosed by Bruchez as the luminescent material in the temperature measuring paint disclosed by Gallery, since these coatings are alternative types of luminescent materials that can be used to determine the temperature of a substrate when irradiated with light (page 6 of the Office Action).

[1] Because the Examiner did not discuss claim 45 specifically in the rejections, Applicants believe that the Examiner meant to include claim 45 in the paragraph of the Office Action relating to claims 32 and 43.

Applicants respectfully disagree. For reasons similar to those described above, neither Gallery nor Bruchez, nor combinations of Gallery and Bruchez teach or suggest a temperature-sensing paint including a semiconductor nanocrystal.

Independent claims 32, 43 and 45 feature a temperature-sensing paint, a method of manufacturing a temperature-sensing paint, and a method of manufacturing a temperature sensor including depositing a temperature sensitive paint on a surface, respectively. In each of the claims, the temperature-sensing paint includes a semiconductor nanocrystal, a binder and a deposition solvent.

The Examiner relies on Gallery for teaching all aspects of independent claims 32, 43 and 45 except for the semiconductor nanocrystal. However, Gallery describes "temperature paint" that includes "rhodamine B base" as the temperature sensitive component. See page 713, column 2, line 52 of Gallery. Rhodamine B is an organic dye. See FIG. 2 of Gallery. Gallery does not teach or suggest any other materials that can be used as a temperature sensor. Instead, Gallery teaches a rhodamine B temperature paint. See Abstract of Gallery. Thus, nothing in Gallery teaches or suggests a temperature-sensing paint includes a semiconductor nanocrystal. Indeed, there is no motivation provided in Britton to choose any material other than rhodamine B to provide real-time temperature measurements. Certainly, there is no motivation to form a temperature-sensing paint includes a semiconductor nanocrystal in Gallery.

As discussed above, Bruchez does not relate to sensing temperature. Instead, Bruchez teaches a method of detecting an analyte in a sample. See Title of Bruchez. Bruchez does not teach or suggest forming a temperature sensor including a matrix including a semiconductor nanocrystal in a binder. Bruchez does not teach or suggest including a matrix on a surface of a substrate. Indeed, Indeed, Bruchez does not even recognize that a semiconductor nanocrystal exhibits a temperature dependent emission spectrum. See, for example, page 11, lines 16-18 of the specification. Without such a recognition or suggestion, there is no motivation in Bruchez to use a semiconductor nanocrystal in a temperature sensor.

There is no motivation to combine the teachings of Bruchez and Gallery. Neither reference recognizes that semiconductor nanocrystals can be used in a method of sensing temperature. For reasons similar to those discussed above, the Examiner has not presented a *prima facie* case of obviousness.

Thus, the independent claims 32, 43 and 45, and claims that depend therefrom, are patentable over the combination of Gallery with Bruchez. Applicants respectfully request reconsideration and withdrawal of this rejection.

New claims

None of the cited references describe or suggest a method of sensing temperature including detecting emission intensity of light from a sensor including a semiconductor nanocrystal. See claims 49 and 50.

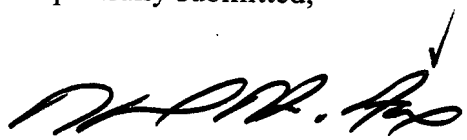
Attached is a marked up version of the changes being made by the current amendment.

CONCLUSION

Applicant asks that all claims be allowed. Enclosed is a check for the required additional claims fees. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: 7-29-02



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Version with markings to show changes made

In the claims:

New claims 49-50 have been added.

Claims 11, 12 and 15 have been amended as follows:

--11. (Amended) The method of claim 1, wherein the semiconductor nanocrystal is a member of a [the] population that emits light in a spectral range of no great than about 75 nm full width at half max (FWHM).--

--12. (Amended) The method of claim 1, wherein the semiconductor nanocrystal is a member of a [the] population exhibits less than a 15% rms deviation in diameter of the [nanocrystal] nanocrystals.--

--15. (Amended) A temperature sensor comprising a matrix containing a semiconductor nanocrystal, the matrix formed from a semiconductor nanocrystal and a binder, a light source arranged to illuminate the semiconductor nanocrystal, and a detector arranged to detect light emitted from the semiconductor nanocrystal.--